Exhibit 18

EFFICIENCIES FROM THE CONSUMER VIEWPOINT

Jerry A. Hausman[*]
Gregory K. Leonard[**]

INTRODUCTION

Section 4 of the Federal Trade Commission (FTC) and Department of Justice (DOJ) *Merger Guidelines* (MG) considers the treatment of efficiencies used in the agencies' merger evaluations.[1] The efficiencies section of the MG, as revised in 1997, discusses various special considerations regarding the specific details of the proposed merger.[2] We propose a different approach to efficiency evaluation within the scope of the MG. Because the antitrust laws are most often interpreted from a consumer welfare viewpoint, we propose to evaluate merger efficiencies using Section 2 of the MG, "Competitive Effects."[3] Mergers that lead to lower prices for consumers after efficiencies are taken into account (i.e., mergers that will be pro-competitive) will increase consumer welfare and therefore should not be opposed by the agencies, regardless of the special considerations contained in Section 4 of the MG.

We also develop results that should be useful to merger analysis where significant efficiencies exist. We demonstrate that so long as demand curves have the expected shape, the minimum amount of marginal cost savings passed on by a monopolist in terms of lower price is one-half of the cost savings. Competition will lead to a higher proportion of cost savings being passed on, and we demonstrate how to calculate the effect on prices in the two leading models of unilateral effects, the Nash-Bertrand differentiated products model and the dominant firm model. We demonstrate that if significant efficiencies exist, post-merger prices may well be lower than those prior to the merger.

However, even if post-merger prices are predicted to increase by a relatively small amount, merger policy perhaps should take account of the efficiency gains to the economy from the merger. After all, the efficiency

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* MacDonald Professor of Economics, Massachusetts Institute of Technology.
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1 U.S. DEP'T OF JUSTICE & FED. TRADE COMM'N, HORIZONTAL MERGER GUIDELINES § 4 (rev. ed. 1997), *reprinted in* 4 Trade Reg. Rep. (CCH) ¶ 13,104, at 20,573-11 to -13 (Apr. 8, 1997) [hereinafter 1997 REVISED MERGER GUIDELINES].

2 *See id.*

3 *See id.* § 2, *reprinted in* 4 Trade Reg. Rep. (CCH) at 20,573-6 to -9.

gains to the economy may be quite large if the cost savings that arise from the efficiencies are significant.

I. PRICES AND COSTS IN ECONOMIC THEORY

Productive efficiencies lead to a reduction in cost for the merged firm. Suppose that initially no change in competition occurs with the merger. What would be the effect on prices to consumers from the cost reduction? Economic theory makes a straightforward prediction: The decrease in cost will lead to a decrease in price, with the relationship between the decreases in cost and price depending on the shape of the demand curve. Later in this Article, we will demonstrate how economic theory places bounds on the relationship between cost and price decreases, given the usual expectation about the shape of a demand curve.[4]

A. *The Effect of a Cost Reduction on the Price to Consumers*

To begin with the extreme case of a monopolist, price will decrease when marginal cost decreases. This claim is unexceptional to any student of intermediate microeconomics.[5] However, we have been continually surprised over the years that many lawyers at the antitrust agencies refuse to accept this proposition and instead claim that a monopolist will "pocket the cost savings" and not pass any of them on to consumers. This claim is based on the incorrect assertion that only competition forces a firm to pass along cost savings. In fact, however, profit maximization by the firm causes it to pass along at least some of the cost savings in terms of a lower price, even if the firm is a monopolist.

Why does profit maximizing behavior cause a monopolist to pass along to consumers some of the cost savings? A monopolist sets its price so that marginal revenue equals marginal cost. If the monopolist lowers its price (by a small amount), three effects result. First, the monopolist achieves lower revenue on its existing unit sales; second, it sells more units because of the lower price; and third, its total costs increase because of the extra production.[6] At the profit maximizing optimum, the net effect of these three terms is zero—they cancel each other out.[7] However, if the last term, which is the cost of the extra production, becomes smaller due to efficiencies, the total net effect becomes positive because the added revenue from the price decrease exceeds the added production cost.[8] Thus, the

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4 *See infra* Part IV.

5 *See, e.g.*, ANDREW MAS-COLELL ET AL., MICROECONOMIC THEORY 429 (1995).

6 A price increase can be analyzed in a similar way if the signs of each term are changed.

7 A small price increase leads to the same result—the three terms cancel each other out.

8 This result requires that the price elasticity exceeds 1.0 (in magnitude) at the initial optimum, which it does as a consequence of profit maximization. *See, e.g.*, DENNIS W. CARLTON & JEFFREY M.

monopolist can increase its profits by reducing its price, causing marginal revenue and marginal cost to be equal once again.

The mathematical formula for the solution to the monopolist's price setting problem is found in most microeconomic textbooks:[9]

$$\frac{p-c}{p} = \frac{1}{\eta} \tag{1}$$

where p is the price, c is the marginal cost, and η is the price elasticity (i.e. the magnitude of the percentage change in quantity divided by the percentage change in price). Rearranging the terms makes the relationship between price and marginal cost more explicit:

$$p = c\frac{\eta}{\eta - 1} = c\delta \tag{2}$$

where $\delta = \eta/(\eta - 1) > 1$ since $\eta > 1$. Thus, price is set as a markup over marginal cost where the markup depends on the parameter δ. In general, δ depends on price. For the special case where δ is constant for small changes in price (e.g., a constant elasticity demand curve), a percentage reduction in marginal cost c of a certain size will lead to an equal sized percentage decrease in price. On a dollar and cents basis, the price decreases by *more* than the cost.

For example, suppose that the price equals $1.00 per unit and the marginal cost is $0.50 per unit so that $\eta = \delta = 2$. If an efficiency improvement causes the marginal cost to decrease to $0.40 per unit, a decrease of 20 percent, the price drops to $0.80 per unit, which is also a decrease of 20 percent. While the change in cost is $0.10 per unit, however, the change in price is $0.20 per unit. Thus, for this example of a constant price elasticity, the monopolist has passed on twice the cost savings caused by the efficiency to consumers in the form of lower prices. The monopolist passes on twice the cost savings because its profits increase by 25 percent due to the fact that it sells more at the lower price.

To demonstrate this outcome using a numerical example, suppose the monopolist sold 100 units at the original price of $1.00 for an overall profit of $50. When it decreases its price to $0.80, it sells 156.25 units. Even

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PERLOFF, MODERN INDUSTRIAL ORGANIZATION 103 (1990) ("Therefore, a common observation is that monopolists never operate on the inelastic portion of their demand curve. That is, monopolists always profit more by changing prices until they reach the elastic portion of their demand curve."). The elastic portion of the demand curve occurs when the demand elasticity equals or exceeds 1.0 in magnitude. According to George Stigler, "It follows immediately that since no monopolist will willingly operate where marginal revenue is negative, he will never willingly operate where demand is inelastic." GEORGE STIGLER, THE THEORY OF PRICE 197 (4th ed. 1987).

9 *See, e.g.*, CARLTON & PERLOFF, *supra* note 8, at 102.

though the per unit profit decreases from $0.50 per unit to $0.40 per unit, overall profits increase from $50 to $62.50 because of the additional units sold. If the monopolist had maintained the price at $1.00 when cost decreased from $0.50 per unit to $0.40 per unit, however, its profit would have only increased from $50 to $60. Therefore, the monopolist can increase its profits by passing along more than the change in cost. The exact proportion depends on equation (2) and the shape of the demand curve.[10] Thus, economic analysis reaches a straightforward conclusion that some of the cost change will be passed on to consumers, even in the case of a monopoly. (We find it difficult to understand why so many lawyers have difficulty accepting this result.)

B. *The Overall Effect of a Cost Reduction on the Economy*

Even if only part of the cost savings is passed on to consumers, efficiency gains still benefit consumers and the economy. As Professor Paul Samuelson states in his well-known economics textbook:

> Efficiency is a central (perhaps *the* central) concern in economics . . . . Productive efficiency occurs when society cannot increase the output of one good without cutting back on another. An efficient economy is on its production-possibility frontier.[11]

A gain in productive efficiency increases the amount of output the economy can produce. Indeed, deviations from productive efficiency cause a "first order" welfare loss to the economy while deviations from allocative efficiency caused by monopoly cause "second order" welfare losses to the economy, which are typically smaller welfare losses.[12] This observation forms the basis for Professor Oliver Williamson's classic article discussing the tradeoff between productive and allocative efficiency in antitrust.[13]

The MG never directly address this basic economic point. Presumably, an objection to recognition of the overall gain in economic efficiency created by a transactional efficiency arising from a merger is based on distribution considerations. That is, if the price increases to consumers while the stockholders of the firm receive most of the gains of increased

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10 We will consider how much of the cost change will be passed on subsequently. *See infra* Part IV.

11 PAUL A. SAUMELSON & WILLIAM D. NORDHAUS, ECONOMICS 28-29 (12th ed. 1985).

12 By first and second order welfare losses we mean the corresponding term in a Taylor's expansion around a Pareto efficient point. The allocative efficiency loss from monopoly arises because the monopoly price exceeds the competitive price and leads to a "deadweight loss." For a further discussion of deadweight loss and its measurement, see, e.g., Alan J. Auerbach, *The Theory of Excess Burden and Optimal Taxation*, *in* ALAN J. AUERBACH & MARTIN FELDSTEIN, HANDBOOK OF PUBLIC ECONOMICS (1985); Jerry A. Hausman, *Exact Consumer's Surplus and Deadweight Loss*, 71 AM. ECON. REV. 662 (1981).

13 Oliver E. Williamson, *Economics as an Antitrust Defense: The Welfare Trade-offs*, 58 AM. ECON. REV. 18, 36 (1968).

efficiency through increased profits, social welfare may well decrease depending on the relative weights used for consumer welfare and for firms' profits.[14] We would expect the antitrust agencies to exercise discretion here since a very small increase in price could be outweighed by a large increase in productive efficiency. Section 4 of the MG seems to recognize the scope of such discretion, and the agencies often weigh expected efficiencies in their decisions.[15]

If consumer welfare increases because of lower prices arising from a merger and the firms' profits also increase, however, we see no good economic reason for federal antitrust agencies to challenge the merger. Because both consumer welfare and producer welfare (profits) increase, no weighting of consumer and producer welfare exists under which total welfare would decline. Yet the MG does not accept this approach, for reasons that we turn to subsequently.[16] First, however, we consider the case of two firms merging where a reduction in competition as well as an increase in efficiency are both present. In such cases the antitrust authorities can determine whether the price to consumers will decrease in that situation.

II. PRICE AND COST WHEN COMPETITION CHANGES BECAUSE OF A MERGER

In the usual case of a merger that causes concern for the antitrust agencies a reduction in competition (holding other factors constant) may occur because the merging firms were competing prior to the merger. Here we consider the situation of unilateral effects discussed in Section 2.2 of the MG.[17] We will consider both situations discussed in Section 2.2, beginning with differentiated products (Section 2.21) and then analyzing the relatively undifferentiated situation (Section 2.22) where the supply response is limited by capacity constraints.

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14 Overall economic efficiency can be expressed (approximately) as the sum of consumer welfare (consumer surplus) plus producer surplus (firms' profits). However, in a given social welfare function the terms may be weighted differently depending on distributional preferences. *See, e.g.*, Auerbach, *supra* note 12.

15 For instance, IMC acquired, from Western Ag, the only other mine in North America that produced a certain type of potash. The acquisition generated substantial operational efficiencies, however, and the DOJ did not oppose the merger.

16 See *infra* Part III.

17 1997 REVISED MERGER GUIDELINES § 2.2, *supra* note 1, at 20,573-8 to -9.

A. *Differentiated Products*[18]

A merger between two firms selling differentiated products has two potential competitive effects. First, to the extent that the products of the merging firms constrain each other's pricing prior to the merger, the merger will remove this competitive constraint, giving the merged firm an incentive to raise its prices. If prices are "strategic complements," the other firms will also raise their prices in an equilibrium.[19] The size of this competitive effect will depend upon the extent of competition between the products in the industry.

Second, the merger could result in production efficiencies (reductions in marginal cost) for the merging firms. The lower marginal costs will generally create an incentive for the merged firm to lower its prices, holding constant the pre-merger equilibrium prices of the other firms. Again, if prices are strategic complements, the equilibrium prices of the other firms will also generally decrease. The size of this competitive effect is directly related to the size of the reductions in marginal cost.

Whether a merger has an overall positive or negative effect on prices depends on whether the first effect is larger than the second effect. We analyze the tradeoff using a static Nash-Bertrand price-setting model for differentiated products,[20] where we compare the pre-merger equilibrium to the post-merger equilibrium. We make two additional assumptions. First, we assume no entry will occur even if prices rise.[21] Second, we assume that the firms' marginal costs are constant over the relevant range of output.

Suppose there are N firms, with each firm producing and selling one brand so that there are N brands. We discuss the case where firms 1 and 2 merge to form a single firm that controls two products post-merger.[22]

Pre-merger, the producer of each brand i seeks to maximize its profits, which are equal to the difference between price and marginal cost multiplied by the quantity of brand i demanded (we ignore fixed costs here):

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18 For further discussion and analysis of this point, see Jerry A. Hausman and Gregory K. Leonard, *Economic Analysis of Differentiated Products Mergers Using Real World Data*, 5 GEO. MASON L. REV. 321 (1997).

19 Prices are strategic complements if the price best response function of one firm is an increasing function of the prices of the other firms. In a price setting game, this condition is related to the products being demand substitutes.

20 *See, e.g.*, Jerry A. Hausman et al., *Competitive Analysis with Differentiated Products*, 34 ANNALES, D'ECONOMIE ET DE STATISTIQUE 159 (1994).

21 Of course, if entry would occur when existing producers attempted to increase price, the economic analysis would need to change to take account of the entry. For instance, if no barriers to entry existed for similar products, any concerns regarding post-merger unilateral effects may be alleviated.

22 The case where the firms have more than one brand is a straightforward extension, which is given in our previous papers. *See, e.g.*, Hausman et al., *supra* note 20.

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$$(p_i - c_i)Q_i(p) \tag{3}$$

In this equation, p_i is the price of brand i, c_i is the marginal cost of brand i, p (with no subscript) is a vector containing the prices of all N brands in the industry, and $Q_i(p)$ is the quantity demanded for brand i given prices p. The producer of brand i chooses its price to maximize its profits, taking the prices of the other brands as given. The first order condition for this maximization problem sets the derivative of profit with respect to p_i equal to zero:

$$Q_i(p) + (p_i - c_i)\frac{\partial Q_i(p)}{\partial p_i} = 0 \tag{4}$$

This equation can be re-arranged to take on the following form:

$$\frac{p_i - c_i}{p_i} = \frac{1}{e_{ii}(p)} \tag{5}$$

where $e_{ii}(p)$ is the absolute value of the own price elasticity for brand i, which is in general a function of the prices of all the brands.[23] Equation (5) says that each producer of i sets its price so that its price-cost markup is equal to the inverse of its own elasticity of demand.

The pre-merger industry equilibrium is defined as the vector of N prices that simultaneously satisfy the first order conditions (5) for all N brands. In other words, the equilibrium vector of industry prices simultaneously solves the system of N first order conditions.

After the merger, a single producer controls both brand 1 and brand 2 and the marginal costs of producing these products are reduced. In general, the pre-merger equilibrium prices will no longer constitute an equilibrium in the post-merger world.

To see why, consider first the merged producer, holding the prices of the other firms at their pre-merger (equilibrium) levels. The merged producer recognizes that if it raises the price of either of its brands, some of the lost demand will go to its other brand, which it also controls. Thus, the pre-merger, price-constraining effect of brand 2 on brand 1 (when it was under separate control) will be eliminated, as will the price-constraining

23 We use the convention that an own-price elasticity is taken to be positive, so that its magnitude is used.

effect of brand 1 on brand 2. Consequently, the merged producer has an incentive to raise its prices.[24]

The merged producer will also take into account the lower marginal costs as a result of the merger-related efficiencies. For the reasons discussed above in the case of a monopolist, the reduced levels of marginal cost give the merged producer an incentive to lower its prices, holding the prices of the other firms at their pre-merger levels.

These two effects give the merged firm incentives to change its prices from their pre-merger equilibrium levels. When its prices change, however, the pre-merger equilibrium prices of the other firms are no longer optimal for those firms. Thus, their prices will also change and the pre-merger equilibrium prices no longer define an equilibrium in the post-merger world.

We now formalize the previous discussion. After the merger, with the two brands 1 and 2 under its control, the profits of the merged producer are the sum of the profits of the two brands:

$$(p_1 - c_1)Q_1(p) + (p_2 - c_2)Q_2(p) \tag{6}$$

When the merged producer sets its two prices optimally, the prices solve the first order equations for the two brands. These first order conditions are the two partial derivatives of (4) with respect to p_1 and p_2. After re-arranging, these two first order conditions can be expressed as:

$$\begin{aligned} -s_1(p)\cdot e_{11}(p)\cdot\frac{p_1 - x_1}{p_1} + s_2(p)\cdot e_{21}(p)\cdot\frac{p_2 - x_2}{p_2} &= -s_1(p) \\ s_1(p)\cdot e_{12}(p)\cdot\frac{p_1 - x_1}{p_1} - s_2(p)\cdot e_{22}(p)\cdot\frac{p_2 - x_2}{p_2} &= -s_2(p) \end{aligned} \tag{7}$$

where the e_{ij}'s denote the elasticities of demand, the s_i's are revenue shares, and x_1 and x_2 denote the post-merger levels of marginal cost for brands 1 and 2 respectively. These post-merger marginal costs incorporate the production efficiencies that result from the merger. Note that both the elasticities and revenue shares are functions of the prices of all N brands and thus in general change as these prices change.

Post-merger, the N-2 producers not involved in the merger still have profit functions taking the form of equation (3). Accordingly, the first order conditions for the prices of the other N-2 brands in the post-merger

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24 We discuss these effects as though they played out in a dynamic setting. Strictly speaking, however, our analysis compares two static equilibria.

situation continue to have a form similar to the first order conditions in the pre-merger situation:[25]

$$\frac{p_i - c_i}{p_i} = \frac{1}{e_{ii}(p)}, \qquad i = 3, \ldots, n \tag{8}$$

In the post-merger equilibrium, the prices of the N brands simultaneously solve the two first order conditions (7) and the N-2 first order conditions (8). Together, the first order conditions (7) and (8) represent a system of N nonlinear equations in N unknown prices. This system of nonlinear equations can be solved to find the post-merger equilibrium prices.

As an example, consider an industry with five firms. One firm is "large" relative to the others, holding a 50 percent share. This firm seeks to merge with a second firm that holds only a 5 percent share. The remaining three firms have shares of 15 percent each.[26] Margins in the industry are low as the firms are highly competitive. Firm 1 has a 23 percent margin and Firm 2 has an 18 percent margin. Pre-merger, all firms charge the same price of $1. The following table summarizes the pre-merger situation for Firms 1 and 2:

	Brand 1	Brand 2
Pre-Merger Prices	$1	$1
Shares	50%	5%
% Margin	23%	18%
Own Elasticity	4.3	5.5
Cross Elasticity w.r.t. other	0.33	3.3

Suppose that the merger will result in no efficiencies. Then, the post-merger price changes would be as follows:

	Post-Merger Price	$ Price Change	% Price Change
Firm 1	$1.024	$0.024	2%
Firm 2	$1.124	$0.124	12%
Firm 3	$1.009	$0.009	1%
Firm 4	$1.009	$0.009	1%
Firm 5	$1.009	$0.009	1%

[25] Note that the own price elasticities in the following equation will, in general, change when prices for the merging goods change.

[26] Firms 3 through 5 are assumed to be symmetric with respect to each other and Firms 1 and 2.

However, now suppose that the merger leads to a marginal cost reduction of 10 percent for both Firms 1 and 2. Thus, Firm 1's cost is reduced by $0.077 and Firm 2's cost is reduced by $0.082. Then, the post-merger prices are as follows:

	Post-Merger Price	$ Price Change	% Price Change
Firm 1	$0.956	-$0.044	-4%
Firm 2	$1.050	$0.050	5%
Firm 3	$0.986	-$0.014	-1%
Firm 4	$0.986	-$0.014	-1%
Firm 5	$0.986	-$0.014	-1%

For Firm 1, the efficiencies offset the reduction in competition, leading to an overall price decline. Indeed, the $0.077 in cost reduction leads to a $0.068 price reduction. Thus, the pass-through for Firm 1 is 88 percent. For Firm 2, however, the efficiencies do not overcome the reduction in competition and price still increases, by $0.05. Nevertheless, 90 percent of the cost reduction is passed through to consumers.

The pro-competitive effect from Firm 2 causes the remaining firms' prices to fall, although by a lesser amount than Firm 1's price. Note that on a weighted average basis, the industry price falls by 2.2 percent. Thus, overall, the merger would be pro-competitive, leading to an increase in consumer welfare.

Equation (7) and the example demonstrate the two counteracting effects from a merger with differentiated products. The terms $(p_j - x_j) / p_j$ have a similar form to equation (5) where price is determined as a markup over marginal cost. When the marginal cost x_j decreases due to a production efficiency, the price also decreases (holding other factors constant). The other effect from the merger arises from the cross-price elasticities $e_{ij}(p)$. The higher the cross price elasticities are, the more closely competitive the merging products are and the greater the price increase, for a given share $s_i(p)$. The merged firm will have an economic incentive to lower prices due to its lower marginal costs, similar to the monopolist, but it will also have an economic incentive to raise prices due to the removal of the competitive constraint of the merged brand. If the efficiency effect is greater than the competitive constraint effect, post-merger price for one or both of the brands could be lower than in the pre-merger situation.[27]

[27] If one price is predicted to increase and the other price is predicted to decrease, we recommend taking a revenue weighted average of the two merging brands. Price changes of non-merging

B. *Relatively Non-Differentiated Products*

The MG also consider the situation of possible unilateral effects when the goods are relatively non-differentiated.[28] We analyze this situation under a dominant firm-price taking fringe model.[29] The industry demand for the product is Q(p). Prior to the merger, the price-taking fringe is characterized by a supply curve S(p). The dominant firm has constant marginal cost of production c.

Prior to the merger, the dominant firm maximizes its profits subject to the behavior of the fringe (i.e., the fringe supplies S(p) given price p). Thus, its maximization problem is

$$\max_p (p-c)[Q(p)-S(p)] \tag{9}$$

The first order condition for the dominant firm is

$$Q(p)-S(p)+(p-c)[Q'(p)-S'(p)]=0 \tag{10}$$

The pre-merger equilibrium price is the solution of this first order condition.

We assume a merger in which the dominant firm acquires capacity from the fringe. We assume that the acquired capacity is "low" on the supply curve, i.e., it is low-cost capacity.[30] Then, in the relevant range of prices the post-merger fringe supply curve is H(p) = S(p) - Δ, where Δ is the amount of acquired capacity. Note that H'(p) = S'(p). We also assume that as a result of the merger, the dominant firm's marginal cost is reduced from c to x. Under these assumptions, the post-merger first order condition for the dominant firm is

$$Q(p)-S(p)+\Delta+(p-x)[Q'(p)-S'(p)]=0 \tag{11}$$

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brands can also be taken into account. However, these predicted price changes are typically small in relation to the merging brands, and if both merging brands prices are predicted to decrease, then prices of competing non-merging brands will also be predicted to decrease in the typical situation.

28 1997 REVISED MERGER GUIDELINES § 2.22, *supra* note 1, at 20,573-9.

29 *See, e.g.*, CARLTON & PERLOFF, *supra* note 8, at 172-74.

30 This assumption avoids a situation where the fringe supply curve would have a discontinuity in the vicinity of the optimum.

Two differences exist between equations (10) and (11). First, the acquired capacity Δ is added to the left-hand-side of (11). Second, the dominant firm's marginal cost in (11) is x instead of c, as it is in (10).

Differentiating equation (11) with respect to Δ (and evaluating at x=c) demonstrates that $\partial p/\partial \Delta > 0$, i.e., that the price increases with the amount of acquired capacity absent any cost savings, as expected. Likewise, differentiating (11) with respect to x (and evaluating at Δ=0) demonstrates that price would decrease with the cost savings, absent any change in the fringe supply. In particular,

$$\frac{\partial p}{\partial x} = \frac{Q'(p) - S'(p)}{2[Q'(p) - S'(p)] + (p - x)[Q''(p) - S''(p)]} \qquad (12)$$

The denominator of this expression is negative by the second order conditions for the dominant firm's optimization problem. The numerator is also negative since $Q'(p) < 0$ and $S'(p) > 0$. Thus, as expected, $\partial p/\partial x > 0$, i.e., the price decreases with a decrease in the dominant firm's cost.

The total effect of the merger depends on whether the price-reducing effect of the cost savings outweigh the price-increasing effect of the fringe capacity reduction. The outcome will depend on the particular circumstances of the case at hand, i.e., the form of the demand curve and fringe supply curve.

As an example, we consider the case of constant elasticity demand and fringe supply. We assume a –1.5 demand elasticity and a 0.1 supply elasticity. Pre-merger, the dominant firm holds a 24 percent market share; its cost is $0.50, and the industry price is $0.84. We assume a merger that involves the dominant firm's acquisition of 15 percent of the pre-merger fringe capacity. Absent any cost savings, straightforward calculations show that this merger would result in price increasing by $0.07 to $0.91, a 9 percent increase. However, if the merger also led to cost savings of $0.06, calculations show that price would remain unchanged post-merger. Thus, in this example, $0.06 in cost savings are sufficient to offset the $0.07 price increase that would otherwise occur. The cost savings are passed through virtually one-for-one to consumers.

III. THE MERGER GUIDELINES APPROACH TO EVALUATION OF EFFICIENCIES

The April 1997 revision of MG Section 4 offers an improved and more specific discussion of efficiencies than previous versions of the

MG.[31] However, we believe that the MG still do not take consumer welfare effects correctly into account in all situations.

A. *The "Merger-Specific Efficiencies" Standard*

The efficiencies section of the MG states that the Department of Justice and Federal Trade Commission (the Agencies hereinafter) will only consider *merger-specific efficiencies*.[32] According to the MG, the Agencies deem an efficiency to be merger-specific only if it cannot be accomplished by another means having a lower anti-competitive effect. This policy can and does harm consumer welfare because it trades off relatively certain welfare gains (generated by the merger under consideration) to speculative potential welfare gains (generated by the hypothetical alternative means suggested by the Agencies).

Suppose two firms propose to merge and the analysis outlined in Part II of this Article demonstrates that post-merger prices will be lower for consumers, so that consumer welfare increases, and that economic efficiency and social welfare increase as well. Based on all of the criteria usually employed by an economist, the merger should take place according to the analysis. If the merger analysis has been done in a reliable fashion, the estimates of the various welfare gains will be reliable.

Under the MG, however, the Agencies still may object to the merger because they believe that a hypothetical different merger, hypothetical joint venture, or other hypothetical outcome could have less anti-competitive consequences. These hypothetical alternatives are typically speculative and not based on a reliable analysis. The hypothetical merger or joint venture may never occur. If the Agencies stop the merger based on a speculative alternative outcome which never actually comes to pass, consumer welfare will be less than it would have been if the proposed merger had been permitted to proceed. Thus, the Agencies may well end up harming consumers by preventing an efficiency-enhancing merger.

Our recommendation is that when a given merger increases consumer welfare, it should be deemed pro-competitive and judged under Section 2 of the MG, the "Competitive Effects" section.[33] Lower prices, post-merger, are by definition pro-competitive. The "Efficiencies" section of the MG (Section 4) should not be used in this situation, because it is unnecessary and can lead to adverse results to consumers and to economic efficiency. The requirement of merger-specific efficiencies provides an unnecessary and potentially harmful standard, since it can lead the Agencies to turn

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31 1997 REVISED MERGER GUIDELINES § 4, *supra* note 1, at 20,573-11.

32 *See id.* at 20,573-13 (emphasis contained in original).

33 *See id.* at 20,573-6.

down a proposed merger that is pro-competitive because the merger does not meet the merger-specific efficiency standard.

Our approach also solves the potential problem of whether the Agencies can claim in a court proceeding that received merger law does not recognize the possible role of efficiencies. Since the goal of the antitrust laws is to protect consumers, when prices decrease for consumers as the result of a merger, application of Section 7 of the Clayton Act[34] would result in approval of the merger. No separate consideration of the possible role of efficiencies is required because the overall outcome would be pro-competitive given that prices would be lower for consumers as result of the merger. It would be an extremely strange position for the Agencies to argue that no effect of efficiencies should be taken into account with respect to the post-merger prices. The resulting prices after the merger form the standard on which to judge changes in consumer welfare.[35] If post-merger prices are predicted to increase even after efficiencies are taken into account, separate consideration of efficiencies might still cause a merger to be approved because of the increase in economic efficiency. When post-merger prices are predicted to decrease, however, the merger should proceed without additional inquiry.

B. *"Pecuniary Efficiencies"*

One further situation may arise where no productive efficiencies arise from a merger, but consumer prices will nevertheless decrease. Suppose that two firms merge and they are able to achieve lower prices from their input suppliers, e.g., through an increase in bargaining power.[36] Marginal costs will decrease because of the merger, and post-merger prices may well decrease to consumers, as before, depending on other economic parameters, such as the relevant cross price elasticities. Here a shift in economic surplus is occurring from producers to consumers. Evaluating the merger based on consumer welfare would cause the merger to proceed because consumers are made better off.

Nevertheless, the Agencies sometimes argue that these reduced prices result from "pecuniary efficiencies" rather than productive efficiencies, and therefore should not be taken into account in the economic analysis.[37] Two problems arise with this argument. First, it is inconsistent with the argument that the part of productive efficiencies that are not passed on to consumers, but only increase producer surplus (profit), should not be taken

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34 15 U.S.C. § 18 (1994 & Supp. II 1996).

35 When using the term prices, we mean quality-adjusted prices to account for possible merged-induced changes in quality.

36 We assume that these lower prices are not the result of the exercise of monopsony power, i.e., no restriction in purchases occurs.

37 *See, e.g.*, FTC v. Staples, Inc., 970 F. Supp. 1066 (D.D.C. 1997).

into account. If increases in producer surplus should not be counted, decreases in producer surplus should not be counted, either.

But the more important problem is that this argument once again loses sight of consumers, the ultimate beneficiaries of the antitrust laws. When prices decrease to consumers as a result of "pecuniary efficiencies," a MG Section 2 analysis states that the outcome is pro-competitive. In our view, this outcome should end the inquiry. The question should be the welfare effects for consumers, not the welfare effects for input suppliers. Otherwise, the Agencies can and will reject mergers that are pro-competitive in that they increase consumer welfare.

IV. THE AMOUNT OF EFFICIENCY PASSED ON THROUGH LOWER PRICES TO CONSUMERS

An important question in our analysis is how much of the cost savings will be passed on to consumers. We have demonstrated that even a monopolist will pass on some of the cost savings, since the lower prices along with the cost savings lead to an increase in the monopolist's profits. Similar results hold for the unilateral effects analysis, but the added factor of a possible decrease in competition from a merger must also be taken into account. For the differentiated products situation, equations (7) and (8) provide the connection between price and cost. To analyze the effects of a merger, the potential change in price can be calculated as long as the demand structure for the products at issue is known. Equations (7) and (8) give the system of nonlinear equations that allows calculation of post-merger prices that can be compared to pre-merger prices to determine if consumer welfare will increase or decrease as a result of the merger.

In some situations, however, sufficient data do not exist to allow estimation of the demand curves.[38] The ability to estimate approximately how much of the cost savings due to the efficiencies will be passed on through lower prices is useful information to determine the merger's effect on prices.

A. *Monopoly*

We start with the case of the monopolist. The monopolist's first order condition is[39]

[38] Given the collection of scanner data, the ability to estimate demand curves is becoming much more possible over a range of situations. *See* Hausman & Leonard, *supra* note 18, and Hausman et al., *supra* note 22, for a further discussion.

[39] We assume throughout this section that the marginal costs are constant over the relevant range of output.

$$(p-c)\frac{\partial Q}{\partial p}+Q=0 \tag{13}$$

The monopolist's profit maximizing price is implicitly defined as a function of cost c by this first order condition. Thus, we can determine the derivative of p with respect to c by differentiating the first order condition (13) to obtain:

$$\left(\frac{\partial p}{\partial c}-1\right)\frac{\partial Q}{\partial p}+(p-c)\frac{\partial^2 Q}{\partial p^2}\frac{\partial p}{\partial c}+\frac{\partial Q}{\partial p}\frac{\partial p}{\partial c}=0 \tag{14}$$

Solving for ∂p/∂c yields

$$\frac{\partial p}{\partial c}=\frac{\frac{\partial Q}{\partial p}}{2\frac{\partial Q}{\partial p}+(p-c)\frac{\partial^2 Q}{\partial p^2}} \tag{15}$$

Since the denominator of the fraction on the right hand side of equation (15) is negative (by the second order conditions for the optimum) and the numerator is also negative, ∂p/∂c is positive, i.e., price decreases with a cost decrease, as we have already derived.[40]

The magnitude of ∂p/∂c depends on the shape of the demand curve. For instance, for the case of linear demand, we have

$$\frac{\partial^2 Q}{\partial p^2}=0 \tag{16}$$

In this case, from equation (15) we see that ∂p/∂c is equal to one-half, i.e., price declines by one cent for every two cents of cost reduction.

Now consider the case of

$$\frac{\partial^2 Q}{\partial p^2}>0 \tag{17}$$

40 Similar equations have been derived previously in the literature. *See, e.g.*, Jeremy I. Bulow & Paul Pfleiderer, *A Note on the Effect of Cost Changes on Prices*, 91 J. POL. ECON. 182 (1983).

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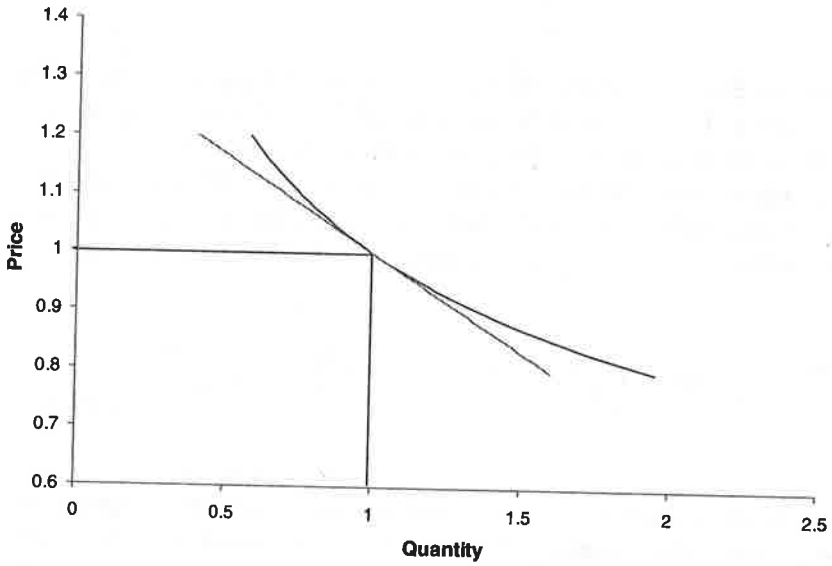
This condition implies that the demand curve is convex relative to the origin.[41] This case holds under a variety of well-known demand curves and, indeed, corresponds to the "typical" demand curve usually drawn on chalkboards by professors teaching undergraduate students.[42] In this case, from equation (15), we see that $\partial p/\partial c$ is greater than one-half. Thus, the linear demand case defines the minimum pass-through (one-half) that we would expect from a monopolist in the situation of a "typical" demand curve. All demand curves in this class other than the linear demand curve would yield greater than one-half pass-through.

In Figure 1 we graph a demand curve which is convex to the origin at a given price p_1. We have also graphed a linear demand curve (the supporting hyperplane) at the same pre-efficiencies price, p_1. The intuitive demonstration that the linear demand curve is the most extreme situation follows because as price decreases and you move down and to the right along the demand curve in Figure 1, any demand curve satisfying (17) will lie above the linear demand curve. Thus, when price decreases starting at point p_1, demand will always be less for the linear demand curve than for any alternative shape of the demand curve for a given small price change.

Figure 1



41 Mathematically, a convex function is one such that if a straight line is used to connect two points of the function, the function evaluated at any point that lies between the two points will be less than the average of the function, so that the straight line lies everywhere above the function.

42 Economic theory has only a single prediction about a demand curve as a function of its own price: the Hicksian (compensated) demand curve is downward sloping. However, the convexity of demand curves is often assumed, presumably because most economists find it to be a natural assump-

Remembering that a firm decreases price when its cost decreases so it can sell more of its product and increase its profits, the firm will achieve the smallest gain in demand for a given change in price from the linear demand curve. Thus, if the actual demand curve is linear, the firm has the least economic incentive to decrease prices for a given change in marginal cost, i.e., the pass through is the smallest. If the demand curve is not linear and is convex to the origin as in Figure 1, the incentive to decease prices will be greater because a greater increase in demand will occur. The conclusion is that a minimum of 50 percent of cost savings that arise from efficiencies will be passed on to consumers in the case of a monopolist.

B. *Differentiated Products Price Competition*

We now turn to the case of differentiated products competition. We again assume the case of N firms each selling one product. The firms simultaneously set prices. We examine the resulting Nash-Bertrand equilibrium. The first order condition for firm *i* is

$$(p_i - c_i)\frac{\partial Q_i(p)}{\partial p_i} + Q_i(p) = 0 \tag{18}$$

where, as discussed above, the demand for firm *i* depends on the prices of all N firms. The system of N equations of form (18) implicitly define the Nash equilibrium prices as functions of the costs of all N firms.

Suppose now the cost of firm *i* decreases. By differentiating first order condition (18), we can obtain the derivative $\partial p_i/\partial c_i$, i.e., the change in the equilibrium price of firm *i* resulting from the decrease in its cost:[43]

$$\left(\frac{\partial p_i}{\partial c_i} - 1\right)\frac{\partial Q_i}{\partial p_i} + (p_i - c_i)\left[\frac{\partial^2 Q_i}{\partial p_i^2}\frac{\partial p_i}{\partial c_i} + \sum_{j \neq i}\frac{\partial^2 Q_i}{\partial p_i \partial p_j}\frac{\partial p_j}{\partial c_j}\right] + \frac{\partial Q_i}{\partial p_i}\frac{\partial p_i}{\partial c_i} + \sum_{j \neq i}\frac{\partial Q_i}{\partial p_j}\frac{\partial p_j}{\partial c_i} = 0 \tag{19}$$

Note the differences between (19) and (14). The monopolist faces no other competition. Thus, changes in its cost affect its price, but no other prices. The differentiated products firm, on the other hand, faces competition from other firms. When its cost changes, in general the entire industry equilib-

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tion given properties of the marginal rate of substitution (MRS). *See, e.g*, PAUL A. SAMUELSON & WILLIAM D. NORDHAUS, ECONOMICS 45 (16th Ed. 1998).

43 For a general approach to comparative statics in this type of situation, see Avinash K. Dixit, *Comparative Statics for Oligopoly*, 27 INT'L ECON. REV. 107 (1996).

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rium is affected. Thus, equation (19) includes the terms $\partial p_j/\partial c_i$, the change in the equilibrium price of firm j caused by a change in firm i's cost. Equation (19) can be rearranged to take the following form:

$$\left[2\frac{\partial Q_i}{\partial p_i} + (p_i - c_i)\frac{\partial^2 Q_i}{\partial p_i^2}\right]\frac{\partial p_i}{\partial c_i} + \sum_{j \neq i}\left((p_i - c_i)\frac{\partial^2 Q_i}{\partial p_i \partial p_j} + \frac{\partial Q_i}{\partial p_j}\right)\frac{\partial p_j}{\partial c_i} = \frac{\partial Q_i}{\partial p_i} \qquad (20)$$

The term inside the first brackets on the left-hand-side of (20) is negative by the second order conditions for firm i's maximization problem. The second term on the left-hand-side of (20) is positive if the products' prices are strategic complements. Thus, for a given initial price and demand curve, $\partial p_j/\partial c_i$ in the differentiated products case is larger than it is for the monopolist case (where the second term on the left-hand-side of (20) is zero).

The intuition for this effect is that the reduced cost gives firm i the incentive to lower its price. In response to its lower price, the other firms lower their prices as well. Then, in response to the lower prices of the other firms, firm i lowers its price somewhat further, and so on until equilibrium is reached. Thus, in some sense, competition leads to a greater pass-through of the cost savings than would exist with no competition.

As with the case of a monopolist, $\partial p_j/\partial c_i$ is greater than one-half for the case of the "typical" demand curve where condition (17) holds and where the products' prices are strategic complements. Indeed, the minimum magnitude for $\partial p_j/\partial c_i$ under this model of differentiated price competition is greater than one-half.[44] For instance, in the case of linear demand, the monopolist passes on one-half of the cost savings. With a two firm differentiated products model with linear demands, the firm experiencing the cost reduction passes on two-thirds of the reduction (the other firm reduces its price by one-third of the cost reduction).[45]

C. *Implications*

These results can have important implications for merger review by the Agencies when significant efficiencies will result from the merger. Often, one-half of the cost savings from efficiency gains will more than outweigh any reasonably predicted price increase caused by the decrease in competition so that overall predicted post-merger prices will decrease. By establishing a lower bound for the proportion of cost savings passed

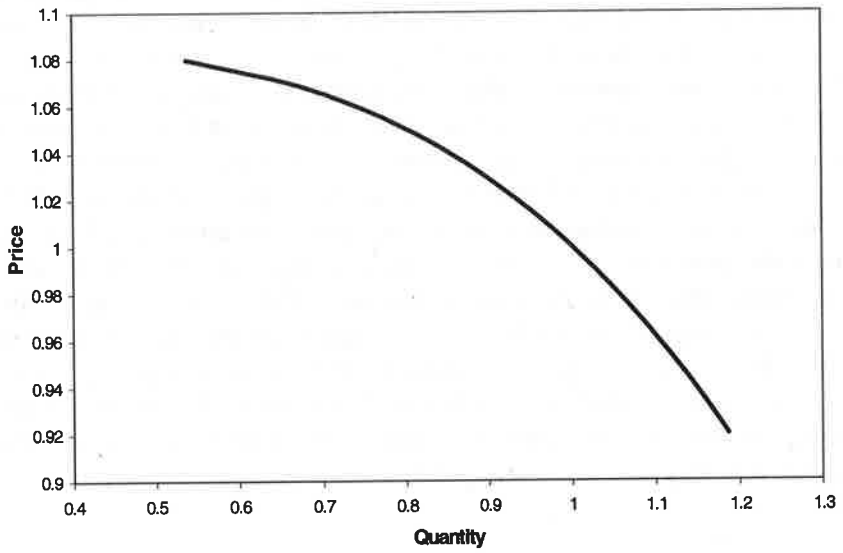
[44] For the dominant firm-fringe model, the minimum pass-through will also be ½ as long as Q''-S''>0. If the demand curve is convex to the origin (Q">0), a sufficient condition is that S"<0.

[45] This example assumes demand curves of the form $Q_i = \alpha + \gamma(p_i - p_j)$.

on, this analysis also should narrow the disagreement among the economists evaluating the potential outcome of the merger.

For instance, in the recent *Staples* case (in which we participated) the FTC Staff put forward a pass-through estimate implying that only 21 percent of the cost savings would be passed on to consumers.[46] Note that this amount of pass-through is less than half of what would occur under the linear demand case (50 percent).[47] Thus, taking the FTC Staff's pass-through estimate at face value, it implies a demand curve that is concave to the origin. Indeed, if we assume a generalized (Box-Cox) demand curve,[48] an initial price-cost margin of 33 percent, and the curvature implied by the Staff's pass-through estimate, the demand curve must have the form shown in Figure 2. Such a demand curve seems quite unlikely to hold in practice, especially in the case of office supplies from Staples.

Figure 2



46 *See* ORLEY ASHENFELTER ET AL., IDENTIFYING THE FIRM-SPECIFIC COST PASS-THROUGH RATE (FTC Working Paper No. 217, 1998).

47 The FTC Staff's estimate was based on a study of 30 products sold by Staples, of which 17 were pens. The implausibility of the 21 percent pass-through number suggests that the Staff's estimates were downward biased, e.g., because of measurement error. The problem of measurement error in this type of study is well recognized in the literature. For a description of the FTC staff approach, see ASHENFELTER ET AL., *supra* note 46.

48 TAKESHI AMEMIYA, ADVANCED ECONOMETRICS 249 (1985).

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V. CONCLUSIONS

If post-merger prices will be lower for consumers, the Agencies should not object to a merger. The antitrust laws are designed to protect consumers, and the Agencies should not take actions that lead to consumer harm. We have demonstrated that all firms, even a monopolist, will typically pass on some of the cost savings that arise from efficiencies because firm profits will increase with a lower price. If the efficiencies are large enough or the reduction in competition is small relative to the size of the cost savings, post-merger prices will be lower than pre-merger prices. Because consumer welfare increases with lower prices, the Agencies should approve the merger.

Section 2 of the MG, which deals with competitive effects, should be used to evaluate the merger. Section 4 of the MG, which deals with efficiencies and imposes the merger-specific efficiencies standard, is poor economic policy that can and has harmed consumers.

With a unilateral effect analysis, in many situations we can estimate post-merger prices given estimates of the cost savings and the structure of demand for the industry. We have demonstrated how these calculations are performed for the differentiated products model and for the dominant firm model of unilateral effects.

In addition, we derived a lower bound of 50 percent of cost savings that will be passed on to consumers, regardless of the specific shape of the demand curve so long as it is convex. The proportion of pass-through will be considerably larger than 50 percent in many situations given the shapes of demand curves that have been found empirically. Thus, if the cost savings are large, they can often outweigh the price-increasing effect arising from the decrease in competition after a merger. The knowledge that at least 50 percent of the cost savings will be passed on to consumers could have a significant effect on the Agencies' evaluations of merger, and should frame the debate between the merging parties and the Agencies during the review of the merger.